WIRING BOARD, ITS PRODUCTION AND LIQUID CRYSTAL ELEMENT HAVING THIS WIRING BOARD

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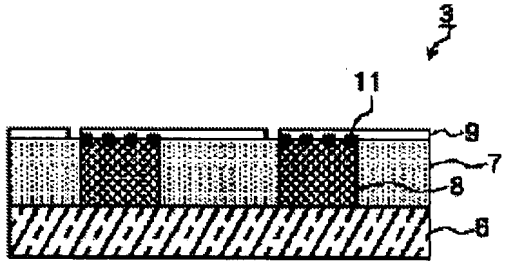
Abstract of **JP9230318**

PROBLEM TO BE SOLVED: To obtain a wiring board with which the curing of the surface of the resin packed between metallic wirings to a smooth surface is possible by arranging spacers in at least part of the boundary surface of the metallic wirings and transparent electrodes. SOLUTION: An Al film is formed by a sputtering method on a glass substrate 6 to form the metallic wirings 8. Further, the spacers 11 of a silica glass system are dispersed into a solvent and the soln. prepd. in such a manner is applied on the surface of the metallic wirings 8 and is then cured. The UV curing resin 7 is dropped in a prescribed amt. between the respective metallic wirings 8 on this glass substrate 6 and thereafter, a mold plate having the smooth surface through which UV light passes is brought into contact with the UV curing resin 7. Next, a prescribed pressure is applied on the integral assembly of the glass substrate 6 and the mold plate holding the UV curing resin 7 to bring both into tight contact with each other. Next, the integral assembly of the glass substrate 6 and the UV curing resin 7 is peeled from the mold plate and transparent electrodes 9 are formed on the UV curing resin 7 in compliance with the wiring patterns of the metallic wirings 8. An alignment layer is formed thereon, by which the wiring board 3 is obtd.



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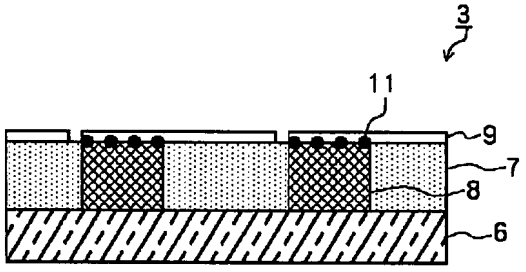
(54)【発明の名称】　配線基板、その製造方法及び該配線基板を備えた液晶素子

(57)【要約】
【課題】樹脂の硬化による収縮を抑制して樹脂表面を平滑にする。
【解決手段】金属配線８上にスペーサー１１を配置して、金属配線８間にＵＶ硬化樹脂７を加圧充填してＵＶ光の照射により硬化することにより、スペーサー１１の変形、及びスペーサ１１の金属配線８内へのもぐり込みによって、ＵＶ硬化樹脂７の硬化による収縮が抑制されてその表面が凹凸のない平滑面になり、透明電極９との密着性がよくなる。



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【特許請求の範囲】

【請求項１】　基板表面に配線パターンされた金属配線と、前記金属配線の間に該金属配線とほぼ同じ厚さで充填された樹脂と、前記樹脂上に前記金属配線と電気的に接するようにして形成された透明電極と、を有する配線基板において、
前記金属配線と前記透明電極の界面の少なくとも一部にスペーサーを配置した、
ことを特徴とする配線基板。

【請求項２】　前記スペーサーはガラス系又は樹脂系の粒子からなり、その粒径は０．０１～１μｍである、
請求項１記載の配線基板。

【請求項３】　前記透明電極はＩＴＯ膜である、
請求項１記載の配線基板。

【請求項４】　前記金属配線は低抵抗の金属又は金属合金で形成される、請求項１記載の配線基板。

【請求項５】　前記樹脂は紫外線硬化樹脂である、
請求項１記載の配線基板。

【請求項６】　前記基板上の前記金属配線間にカラーフィルターを配置した、
請求項１記載の配線基板。

【請求項７】　前記基板と前記金属配線との間にカラーフィルターを配置した、
請求項１記載の配線基板。

【請求項８】　前記カラーフィルターと前記金属配線との間に前記カラーフィルターの保護層を形成した、
請求項７記載の配線基板。

【請求項９】　基板上に金属配線を形成する第１の工程と、前記金属配線の間に樹脂を充填し、前記樹脂を型板を介して加圧する第２の工程と、前記樹脂に光を照射して硬化させる第３の工程と、前記型板を離型して、前記樹脂上に前記金属配線と電気的に接するようにして前記透明電極を形成する第４の工程と、を有する配線基板の製造方法において、
前記第２の工程で、前記金属配線と前記型板との間にスペーサを配置して、前記金属配線と前記型板の間に前記樹脂を加圧充填する、
ことを特徴とする配線基板の製造方法。

【請求項１０】　前記スペーサーはガラス系又は樹脂系の粒子からなり、その粒径は０．０１～１μｍである、
請求項９記載の配線基板の製造方法。

【請求項１１】　前記透明電極はＩＴＯ膜である、
請求項９記載の配線基板の製造方法。

【請求項１２】　前記金属配線は低抵抗の金属又は金属合金で形成される、請求項９記載の配線基板の製造方法。

【請求項１３】前記光は紫外線光である、
請求項９記載の配線基板の製造方法。

【請求項１４】　前記樹脂は紫外線硬化樹脂である、
請求項９記載の配線基板の製造方法。

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【請求項１５】　前記基板上の前記金属配線間にカラーフィルターを配置した、
請求項９記載の配線基板の製造方法。

【請求項１６】　前記基板と前記透明電極との間にカラーフィルターを配置した、
請求項９記載の配線基板の製造方法。

【請求項１７】　前記カラーフィルターと前記金属配線との間に前記カラーフィルターの保護層を形成した、
請求項１６記載の配線基板の製造方法。

【請求項１８】　互いに対向するように配置された一対の電極基板の間に液晶を挟持してなる液晶素子において、
少なくとも一方の前記電極基板は、基板と、
前記基板表面に配線パターンされた金属配線と、
前記金属配線の間に該金属配線とほぼ同じ厚さに充填された樹脂と、
前記樹脂上に前記金属配線と電気的に接するようにして形成された透明電極と、からなり、
前記金属配線と前記透明電極の界面の少なくとも一部にスペーサーを配置した、
ことを特徴とする液晶素子。

【請求項１９】　前記スペーサーはガラス系又は樹脂系の粒子からなり、その粒径は０．０１～１μｍである、
請求項１８記載の液晶素子。

【請求項２０】　前記基板はガラス基板である、
請求項１８記載の液晶素子。

【請求項２１】　前記透明電極はＩＴＯ膜である、
請求項１８記載の液晶素子。

【請求項２２】　前記金属配線は低抵抗の金属又は金属合金で形成される、
請求項１８記載の液晶素子。

【請求項２３】　前記樹脂は紫外線硬化樹脂である、
請求項１８記載の液晶素子。

【請求項２４】　前記基板上の前記金属配線間にカラーフィルターを配置した、
請求項１８記載の液晶素子。

【請求項２５】　前記基板と前記金属配線との間にカラーフィルターを配置した、
請求項１８記載の液晶素子。

【請求項２６】　前記カラーフィルターと前記金属配線との間に前記カラーフィルターの保護層を形成した、
請求項２５記載の液晶素子。

【請求項２７】　前記液晶は強誘電性液晶である、
請求項１８記載の液晶素子。

【請求項２８】　前記強誘電性液晶はカイラルスメクチック液晶である、
請求項２７記載の液晶素子。

【請求項２９】　前記透明電極上に配向膜を形成した、
請求項１８記載の液晶素子。

【請求項３０】　前記各電極基板の前記透明電極及び前

記金属配線は単純マトリクス配置される、
請求項１８記載の液晶素子。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、配線基板、特に金属配線上に透明電極を形成した配線基板、その製造方法及び該配線基板を備えた液晶素子に関する。
【０００２】
【従来の技術】ＴＮ（Twisted Nematic ）やＳＴＮ（Super Twisted Nematic ）型等の液晶素子では、従来より、ガラス基板上に形成される透明電極にはＩＴＯ（Indium TinOxide ）膜が一般に用いられている。
【０００３】上述した透明電極を構成するＩＴＯ膜は抵抗値が高いため、最近のように表示面積の大型化、高精細化に伴って印加される電圧波形の遅延が問題になってきた。特に、強誘電性液晶を用いた液晶素子ではセルギャップが１～３μｍとより狭いため、電圧波形の遅延が顕著であった。また、抵抗値を低くするために透明電極を厚く形成することも考えられるが、膜厚を厚くすると成膜に時間、コストがかかる、透明性が悪くなる等の問題点があった。
【０００４】このような問題点を解決するために、膜厚の薄い透明電極に併設して低抵抗値の金属配線を形成する構成の電極基板が提案されている（例えば、特開平２－６３０１９号公報）。この公報に開示されている電極基板は、金属配線を透明な絶縁物で埋め込み、表面に金属パターンを露出した金属配線上に、ＩＴＯ膜等の透明電極を形成したものである。
【０００５】上述したような構成の電極基板を作製する場合、金属配線間を埋めて平坦化する絶縁物として透明な樹脂を用いる構成の電極基板が提案されている（例えば、特開平６－３４７８１０号公報）。
【０００６】このような低抵抗率の金属配線を、透明電極を形成する下地のガラス基板に形成して電極基板（配線基板）を作製する場合、従来、例えば図９乃至図１１に示すような製造方法によって行われていた。
【０００７】先ず、ガラス基板１０１上に、１μｍ程度の膜厚からなる金属配線１０２を形成する（図９（ａ）参照）。金属配線１０２は、例えばスパッタ法等によってガラス基板１０１上に金属膜層を形成した後、フォトリソ法によりパターンニングして形成することができる。
【０００８】次に、シランカップリング処理を施したガラス基板１０１上に、ＵＶ（紫外線）硬化樹脂１０３を定量液化治具（図示省略）で所定量滴下し（図９（ｂ）参照）、平滑な型板１０４でＵＶ硬化樹脂１０３を挟むように接触させる（図９（ｃ）参照）。
【０００９】次に、ガラス基板１０１と型板１０４とでＵＶ硬化樹脂１０３を挟んだ一体物をプレス機（図示省略）内に入れ、加圧してガラス基板１０１と型板１０４を密着させる（図１０（ａ）参照）。この時、後の工程でＩＴＯ膜等の透明電極と金属配線１０２が接触して導通性を保つようにするため、ＵＶ硬化樹脂１０３を金属配線１０２の表面上から除去するか、又は極薄く樹脂が残る程度になるように、ガラス基板１０１と型板１０４とを強く、しかも基板全面に均一に密着させる。
【００１０】次に、このＵＶ硬化樹脂１０３を硬化させるために、ガラス基板１０１と型板１０４の一体物をプレス機（図示省略）内から取り出し、型板１０４側からＵＶ（紫外線）光１０５を照射してＵＶ硬化樹脂１０３を硬化させる（図１０（ｂ）参照）。
【００１１】次に、離型治具（図示省略）により型板１０４からガラス基板１０１とＵＶ硬化樹脂１０３の一体物を剥離し（図１０（ｃ），（ｄ）参照）、ＵＶ硬化樹脂１０３上に金属配線１０２と電気的に接するようにしてＩＴＯ膜からなる透明電極１０６を成膜、パターニングして、金属配線１０２をＵＶ硬化樹脂１０３埋め込んだ電極基板（配線基板）１００を得ていた（図１１参照）。
【００１２】
【発明が解決しようとする課題】ところで、上述した従来の製造方法によって作製される電極基板（配線基板）１００では、図１０（ｂ）に示したようにＵＶ硬化樹脂１０３にＵＶ光１０５が照射されると、ＵＶ硬化樹脂１０３の硬化による収縮力Ｆによりその表面に収縮が生じて、ＵＶ硬化樹脂１０３の表面が平滑面でなく凹凸面１０３ａになるという問題点があった。以下、ＵＶ硬化樹脂１０３の表面が凹凸面１０３ａになることについて説明する。
【００１３】ＵＶ硬化樹脂１０３は一般に数％の硬化収縮率αを有しており、例えばアクリル系樹脂で６～１０％、エポキシ系樹脂で２～５％である。そして、ガラス基板１０１上に形成される金属配線１０２の厚みをｈとすると、金属配線１０２間に充填されるＵＶ硬化樹脂１０３には単位体積当たり、α（硬化収縮率）×ｈ（厚み）に相当する収縮力、即ち、α（硬化収縮率）×ｈ（厚み）の厚み分だけ縮もうとする力が、型板１０４とＵＶ硬化樹脂１０３の界面に働く。
【００１４】この際、金属配線１０２が、型板１０４とＵＶ硬化樹脂１０３間の支柱として機能するため、上述した収縮力はＵＶ硬化樹脂１０３の密着性を向上させるために、シランカップリング処理が施されているガラス基板１０１ではなく、シランカップリング処理が施されていない型板１０４からＵＶ硬化樹脂１０３を引き剥がそうとする力として働き、その結果、ＵＶ硬化樹脂１０３が型板１０４から離型する。
【００１５】そして、この離型が急激に起こるために、離型する際にＵＶ硬化樹脂１０３の表面に収縮による凹凸面１０３ａが形成されることとなる。
【００１６】このように、ＵＶ硬化樹脂１０３の表面が

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凹凸面１０３ａとなることにより、その表面に成膜されるＩＴＯ膜からなる透明電極１０６も同様に表面が平滑面でなく凹凸面となる。このため、ＵＶ硬化樹脂１０３と透明電極１０６との接触面の平坦性が悪くなり、ＵＶ硬化樹脂１０３と透明電極１０６との密着性が悪くなる。

【００１７】更に、一対のこの配線基板（配線基板）１００間に液晶を注入して得られる液晶素子では、透明電極１０６上に形成される配向膜（図示省略）の表面も同様に凹凸面となる。このため、配向処理が均一でなく乱れた状態となり、光学状態のムラやクロストークが発生して表示品位の低下を招くという問題点があった。

【００１８】そこで、本発明は、金属配線間に充填する樹脂表面を平滑な面にして硬化することができる配線基板、その製造方法及び該配線基板を備えた液晶素子を提供することを目的とする。

【００１９】

【課題を解決するための手段】上記のような問題を解決するために、基板表面に配線パターンされた金属配線と、前記金属配線の間に該金属配線とほぼ同じ厚さで充填された樹脂と、前記樹脂上に前記金属配線と電気的に接するようにして形成された透明電極と、を有する配線基板において、前記金属配線と前記透明電極の界面の少なくとも一部にスペーサーを配置したことを特徴としている。

【００２０】また、基板上に金属配線を形成する第１の工程と、前記金属配線の間に樹脂を充填し、前記樹脂を型板を介して加圧する第２の工程と、前記樹脂に光を照射して硬化させる第３の工程と、前記型板を離型して、前記樹脂上に前記金属配線と電気的に接するようにして前記透明電極を形成する第４の工程と、を有する配線基板の製造方法において、前記第２の工程で、前記金属配線と前記型板との間にスペーサを配置して、前記金属配線と前記型板の間に前記樹脂を加圧充填することを特徴としている。

【００２１】また、互いに対向するように配置された一対の電極基板の間に液晶を挟持してなる液晶素子において、少なくとも一方の前記電極基板は、基板と、前記基板表面に配線パターンされた金属配線と、前記金属配線の間に該金属配線とほぼ同じ厚さで充填された樹脂と、前記樹脂上に前記金属配線と電気的に接するようにして形成された透明電極と、からなり、前記金属配線と透明電極の界面の少なくとも一部にスペーサーを配置したことを特徴としている。

【００２２】また、前記スペーサーはガラス系又は樹脂系の粒子からなり、その粒径は０．０１～１μｍであることを特徴としている。

【００２３】

【発明の実施の形態】以下、図面に基づいて本発明の実施の形態を説明する。

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【００２４】図１は、本発明の第１の実施の形態に係る配線基板を備えた液晶素子を示す概略断面図である。この液晶素子１は、偏光板２ａ，２ｂ間に対向して配置された一対の配線基板である電極基板３ａ，３ｂを備えており、電極基板３ａ，３ｂは、径が均一な粒状のスペーサ４により所定のセルギャップ（例えば、１．５μｍ）で貼り付けられており、その間に電界に対して双安定性を有する強誘電性液晶であるカイラルスメクチック液晶５が注入され、シール部材（図示省略）によって封止されている。

【００２５】電極基板（配線基板）３ａ，３ｂは、ガラス基板６ａ，６ｂと、ガラス基板６ａ，６ｂ上で絶縁膜であるＵＶ（紫外線）硬化樹脂７（電極基板３ｂ側は図示されていない）内に埋め込まれている低抵抗の金属膜からなる金属配線８ａ，８ｂと、金属配線８ａ，８ｂ上に形成されて金属配線８ａ，８ｂと電気的に接しているＩＴＯ膜からなる透明電極９ａ，９ｂとでそれぞれ構成されている。透明電極９ａ，９ｂ上には、配向膜１０ａ，１０ｂがそれぞれ形成されている。

【００２６】各電極基板３ａ，３ｂの金属配線８ａ，８ｂ、透明電極９ａ，９ｂは、ストライプ状にそれぞれ形成されて単純マトリクス配置され、その交差部で画素が形成されている。

【００２７】ガラス基板６ａ，６ｂは、液晶基板用としてよく用いられる厚さが１ｍｍ程度で、材質はソーダガラス（青板ガラス）のような一般的なものでよく、両面を研磨した平行度のよいものが好ましい。

【００２８】ＵＶ硬化樹脂７は、ＵＶ硬化型樹脂モノマー、オリゴマー及び光開始剤の混合物であり、アクリル系、エポキシ系、エン・チオール系等のいかなる重合方式の物でもよいが、液晶基板作製工程であるＩＴＯスパッタ成膜工程や配向膜焼成工程に耐えうる耐熱性、耐薬品性、耐洗浄性を備えていることが必要である。例えば、主成分である反応性オリゴマーに耐熱性のある分子構造を導入したものや、多官能モノマーにより架橋密度を高めたものが好ましい。

【００２９】尚、ＵＶ硬化樹脂７にはＵＶ（紫外線）光が照射されるが、ＵＶ硬化樹脂以外にも、例えば可視光や赤外線光等の照射によって硬化する樹脂を用いることもできる。

【００３０】また、金属配線８ａ，８ｂの表面には、粒状のスペーサ１１が多数配置されており、製造時にＵＶ硬化樹脂７の硬化による表面の収縮を抑制することができる（詳細は後述する）。

【００３１】スペーサー１１は、ファイバースペーサー、シリカガラス系粒状スペーサー、樹脂系粒状スペーサー、又はこれらのスペーサー表面をメッキ等で金属をコーティングした導電性スペーサー等が用いられる。また、その径の大きさは、ＵＶ硬化樹脂７の種類や金属配線８ａ，８ｂの厚みにもよるが、０．０１～１μｍ程

度、好ましくは、０．０５～０．５μｍ程度がよい。

【００３２】次に、上述した液晶素子１の電極基板３ａ，３ｂに適用される本実施の形態に係る配線基板の製造方法を、図２乃至図４を参照して説明する。

【００３３】先ず、寸法３００×３１０ｍｍで厚さ１．１ｍｍの両面研磨されたガラス基板６上に、スパッタ法により厚さ２μｍのAl（アルミニウム）膜を成膜し、フォトリソエッチング法により幅２０μｍでピッチ３２０μｍのストライプ形状の金属配線８を形成した（図２（ａ）参照）。更に、この金属配線８の表面に、例えば平均粒子径０．２μｍのシリカガラス系のスペーサー（０．０１重量部）１１を溶剤（例えば、イソプロピルアルコールの９９．９９重量部）に分散させてインクジェットプリンタ装置（図示省略）で塗布した後、１２０℃で３０分間キュアした（図２（ａ）参照）。

【００３４】そして、このガラス基板６上に、シランカップリング剤（例えば、日本ユニカー（株）社製：Ａ－１７４（１重量部）とエチルアルコール（４０重量部））をスピンコートし、１００℃で２０分熱処理を行い密着処理を施した。

【００３５】次に、ガラス基板６上の各金属配線８間にディスペンサー等の定量滴下治具（図示省略）を用いてＵＶ硬化樹脂（例えば、ペンタエリスリトールトリアクリレート５０重量部、ネオペンチルグリコールジアクリレート５０重量部、１－ヒドロキシシクロヘキシルフェニルケトン２重量部からなる硬化収縮率７％の樹脂）７を所定量滴下した後、寸法３００×３１０ｍｍの両面研磨されたＵＶ光が透過する表面が平滑な型板１２を、気泡を巻き込まないようにゆっくりとＵＶ硬化樹脂７に接触させた（図２（ｂ），（ｃ）参照）。

【００３６】次に、ＵＶ硬化樹脂７を挟んだガラス基板６と型板１２の一体物に対して、プレス機（図示省略）で上下から例えば１分間かけて所定の圧力（例えば、プレス圧３トン）を加えて全面にわたって密着させ（図３（ａ）参照）、その後（例えば、約１０分後）、プレス機（図示省略）から取り外したガラス基板６と型板１２の一体物に対し、型板１２側からＵＶ光（例えば、１００ｗの高圧水銀ランプ４本で構成された紫外線ランプから照射されるＵＶ光）１３を照射してＵＶ硬化樹脂７を硬化させた（図３（ｂ）参照）。

【００３７】この際、ＵＶ光１３の照射によるＵＶ硬化樹脂７の硬化に伴う収縮力Ｆは、金属配線８の表面に塗布したスペーサー１１の変形、及びスペーサー１１の金属配線８内へのもぐり込みによって抑制されることにより、ＵＶ硬化樹脂７の表面はほぼ平滑面となる。尚、ＵＶ硬化樹脂７の硬化に伴う収縮力によるスペーサー１１の金属配線８内へのもぐり込み量は、スペーサー１１の径の大きさによって調整することができる。

【００３８】また、ＵＶ硬化樹脂７を加圧するプレス機としては、例えば油圧シリンダーやエアーシリンダーによるプレス機、ロールプレス機等を用いることができる。尚、プレス機で加圧する際に、電熱ヒータ又は加熱流体等に通して加熱しておくことにより、ＵＶ硬化樹脂７の粘土が低下してガラス基板６上に良好に広がる。

【００３９】次に、離型装置（図示省略）を用いて型板１２からガラス基板６とＵＶ硬化樹脂７の一体物を剥離し（図３（ｃ），（ｄ）参照）、ＵＶ硬化樹脂７上に、金属配線８と電気的に接するように金属配線８の配線パターンに合わせて、例えば幅３００μｍ、ピッチ３２０μｍのＩＴＯ膜からなる透明電極９をスパッタ形成、パターンニングし、その上に配向膜（図示省略）を形成して、配線基板（図１の液晶素子１の電極基板３ａ，３ｂに相当している）３を得た（図４参照）。

【００４０】そして、この配線基板３を２枚作製して対向配置し、１．５μｍ程度のセルギャップで貼り合わせてその間にカイラルスメクチック液晶を注入することによって、図１に示した液晶素子１を得た。

【００４１】このように、本実施の形態では、製造時のＵＶ光１３の照射によるＵＶ硬化樹脂７の硬化に伴う収縮力は、金属配線８の表面に配置したスペーサー１１の変形、及びスペーサー１１の金属配線８内へのもぐり込みによって抑制されることによって、ＵＶ硬化樹脂７の表面は平滑面になる。

【００４２】そこで、この配線基板３の表面を顕微鏡観察したところ、図１１に示した従来例のような表面の凹凸はほとんど観察されず、ＵＶ硬化樹脂７と透明電極９は良好に密着していた。また、スペーサー１１は、金属配線８の表面から０．１４μｍ程度内部にもぐり込んでいるのが観察され、更に、この電極基板（配線基板）３のパターン長の抵抗値を測定したところ、３００Ω以下の低抵抗値であった。そして、本実施の形態に係る配線基板（電極基板）３を備えた液晶素子は、上述したようにＵＶ硬化樹脂７の表面が凹凸のない平滑面になるので、配向膜の表面も凹凸のない平滑面となって均一に配向処理されることによって、液晶分子の反転が均一に行われることにより、光学状態のムラやクロストーク等をなくして表示品位の向上を図ることができた。

【００４３】また、この液晶素子は、透明電極９の下に金属配線８が併設される構成により、電極の抵抗値が小さくなることによって、強誘電性液晶（本実施の形態では、カイラルスメクチック液晶を用いた）を用いていても電圧波形の遅延を低減することができる。

【００４４】更に、この液晶素子は、金属配線８の併設により透明電極９を厚くする必要がないので、透明電極９の透過率が下がってこの透明電極９が認識されることはない。

【００４５】図５（ａ），（ｂ）は、本発明の第２の実施の形態に係る上述した液晶素子１の電極基板３ａ，３ｂに適用される配線基板の製造工程を模式的に示したものである。

【００４６】本実施の形態では、上述した第１の実施の形態と同様な方法でスペーサー１１を型板１２上に配置して、この型板１２上にＵＶ硬化樹脂７を滴下した後（図５（ａ）参照）、その上方から金属配線８を形成したガラス基板６の金属配線８をＵＶ硬化樹脂７に接触させるようにした（図５（ｂ）参照）。その後、図３乃至図４に示した第１の実施の形態と同様の工程で配線基板を作製した。

【００４７】このように、本実施の形態においても第１の実施の形態と同様、ＵＶ光１３の照射によるＵＶ硬化樹脂７の硬化に伴う収縮力は、金属配線８の表面に配置したスペーサー１１の変形、及びスペーサー１１の金属配線８内へのもぐり込みによって抑制されることによってＵＶ硬化樹脂７の表面は平滑面となり、ＵＶ硬化樹脂７と透明電極９は良好に密着していた。

【００４８】よって、本実施の形態に係る配線基板（電極基板）を備えた液晶素子は、上述したようにＵＶ硬化樹脂７の表面が凹凸のない平滑面になるので、配向膜の表面も凹凸のない平滑面となって均一に配向処理されることによって、液晶分子の反転が均一に行われることにより、光学状態のムラやクロストーク等をなくして表示品位の向上を図ることができた。

【００４９】図６（ａ），（ｂ），（ｃ）は、本発明の第３の実施の形態に係る上述した液晶素子１の電極基板３ａ，３ｂに適用される配線基板の製造工程を模式的に示したものである。

【００５０】本実施の形態では、第１の実施の形態と同様、ガラス基板６上に金属配線８を形成してその表面にスペーサー１１を塗布した後、ガラス基板６上の金属配線８間に赤（Ｒ），緑（Ｇ），青（Ｂ）の各画素で構成される顔料系のカラーフィルター１４を、例えばフォトリソエッチング法により約１μｍの膜厚で形成した（図６（ａ）参照）。その後、図３乃至図４に示した第１の実施の形態と同様の工程でカラーフィルター１４上の各金属配線８間にＵＶ硬化樹脂７を充填して硬化させ（図６（ｂ）参照）、金属配線８の配線パターンに合わせて、例えば幅３００μｍ、ピッチ３２０μｍのＩＴＯ膜からなる透明電極９をスパッタ形成、パターンニングし、その上に配向膜（図示省略）を形成して、配線基板（図１の液晶素子１の電極基板３ａ，３ｂに相当している）３ｃを得た（図６（ｃ）参照）。このように、本実施の形態によれば、カラーフィルター機能を有する配線基板３ｃにおいても第１の実施の形態と同様、ＵＶ光１３の照射によるＵＶ硬化樹脂７の硬化に伴う収縮力は、金属配線８の表面に配置したスペーサー１１の変形、及びスペーサー１１の金属配線８内へのもぐり込みによって抑制されることにより、ＵＶ硬化樹脂７の表面はほぼ平滑面となり、ＵＶ硬化樹脂７と透明電極９は良好に密着していた。

【００５１】よって、本実施の形態に係るカラーフィルター機能を有する配線基板（電極基板）３ｃを備えた液晶素子は、上述したようにＵＶ硬化樹脂７の表面が凹凸のない平滑面になるので、配向膜の表面も凹凸のない平滑面となって均一に配向処理されることによって、液晶分子の反転が均一に行われることにより、光学状態のムラやクロストーク等をなくして表示品位の向上を図ることができた。

【００５２】尚、カラーフィルター１４は、フォトリソエッチング法以外にも、例えば印刷法、昇華転写法、インクジェット法によっても形成することができる。

【００５３】図７（ａ），（ｂ），（ｃ）は、本発明の第４の実施の形態に係る上述した液晶素子１の電極基板３ａ，３ｂに適用される配線基板の製造工程を模式的に示したものである。

【００５４】本実施の形態では、先ず、第１の実施の形態で用いたガラス基板６上に親水性アクリル系のインク受容層（カラーフィルター層）１５を、例えばスピンコートにより０．８μｍの膜厚に形成し、その後、カラーフィルター用インクジェットプリンタ（図示省略）により水性のカラーフィルター用染料インキを、例えば幅３００μｍ、ピッチ３２０μｍで打ち込んでインク受容層１５に染み込ませ、更に、２００℃で３０分加熱し硬化処理してカラーフィルター１６を形成した（図６（ａ）参照）。

【００５５】そして、このカラーフィルター１６上に第１の実施の形態と同様、スパッタ法により厚さ２μｍのＡｌ（アルミニウム）膜を成膜して、フォトリソエッチング法により幅２０μｍ、ピッチ３２０μｍのストライプ形状の金属配線８を形成し、その表面にスペーサー１１を塗布した（図１０（ａ）参照）。その後、図２（ｂ）乃至図３に示した第１の実施の形態と同様の工程でカラーフィルター１６上の各金属配線８間にＵＶ硬化樹脂７を充填して硬化させ（図７（ｂ）参照）、金属配線８の配線パターンに合わせて、例えば幅３００μｍ、ピッチ３２０μｍのＩＴＯ膜からなる透明電極９をスパッタ形成、パターンニングし、その上に配向膜（図示省略）を形成して、配線基板（図１の液晶素子１の電極基板３ａ，３ｂに相当している）３ｄを得た（図７（ｃ）参照）。

【００５６】このように、本実施の形態によれば、カラーフィルター１６上に金属配線８を有する配線基板３ｄにおいても第１の実施の形態と同様、ＵＶ光１３の照射によるＵＶ硬化樹脂７の硬化に伴う収縮力は、金属配線８の表面に配置したスペーサー１１の変形、及びスペーサー１１の金属配線８内へのもぐり込みによって抑制されることによってＵＶ硬化樹脂７の表面は平滑面となり、ＵＶ硬化樹脂７と透明電極９は良好に密着していた。

【００５７】従って、本実施の形態に係るカラーフィルター機能を有する配線基板（電極基板）３ｄを備えた液

晶素子は、上述したようにＵＶ硬化樹脂７の表面が凹凸のない平滑面になるので、配向膜の表面も凹凸のない平滑面となって均一に配向処理されることによって、液晶分子の反転が均一に行われることにより、光学状態のムラやクロストーク等をなくして表示品位の向上を図ることができた。

【００５８】図８（ａ），（ｂ），（ｃ）は、本発明の第５の実施の形態に係る上述した液晶素子１の電極基板３ａ，３ｂに適用される配線基板の製造工程を模式的に示したものである。

【００５９】本実施の形態では、上述した第４の実施の形態と同様な方法で第１の実施の形態で用いたガラス基板６上のインク受容層（カラーフィルー層）１５にカラーフィルター１６を形成し、更に、その表面に保護層（例えば、ポリアミド系の透明コーティング剤）１７を、約０．５μｍの膜厚でスピンコート及びベーキングにより形成した。その後、この保護層１７上に第１の実施の形態と同様、スパッタ法により厚さ２μｍのAl（アルミニウム）膜を成膜して、フォトリソエッチング法により幅２０μｍ、ピッチ３２０μｍのストライプ形状の金属配線８を形成し、その表面にスペーサー１１を塗布した（図８（ａ）参照）。

【００６０】その後、図２（ｂ）乃至図３に示した第１の実施の形態と同様の工程で保護層１７上の各金属配線８間にＵＶ硬化樹脂７を充填して硬化させ（図８（ｂ）参照）、金属配線８の配線パターンに合わせて、例えば幅３００μｍ、ピッチ３２０μｍのＩＴＯ膜からなる透明電極９をスパッタ形成、パターンニングし、その上に配向膜（図示省略）を形成して、配線基板（図１の液晶素子１の電極基板３ａ，３ｂに相当している）３ｅを得た（図８（ｃ）参照）。

【００６１】このように、本実施の形態によれば、カラーフィルター１６の保護層１７上に金属配線８を有する配線基板３ｅにおいても第１の実施の形態と同様、ＵＶ光１３の照射によるＵＶ硬化樹脂７の硬化に伴う収縮力は、金属配線８の表面に配置したスペーサー１１の変形、及びスペーサー１１の金属配線８内へのもぐり込みによって抑制されることによってＵＶ硬化樹脂７の表面はほぼ平滑面となり、ＵＶ硬化樹脂７と透明電極９は良好に密着していた。

【００６２】従って、本実施の形態に係るカラーフィルター機能を有する配線基板（電極基板）３ｅを備えた液晶素子は、上述したようにＵＶ硬化樹脂７の表面が凹凸のない平滑面になるので、配向膜の表面も凹凸のない平滑面となって均一に配向処理されることによって、液晶分子の反転が均一に行われることにより、光学状態のムラやクロストーク等をなくして表示品位の向上を図ることができた。

【００６３】また、カラーフィルター１６上に形成した保護層１７により、フォトリソエッチング法により金属配線８を形成した際に、酸等のエッチング液によるカラーフィルター１６の脱色等を防止することができる。

【００６４】

【発明の効果】以上説明したように、本発明によれば、金属配線と透明電極の界面に配置したスペーサーにより、金属配線の間に充填される樹脂の硬化による収縮を抑制して樹脂表面が平滑で、樹脂と透明電極が良好に密着した配線基板を提供することができる。

【００６５】また、本発明に係る配線基板の製造方法によれば、金属配線と型板との間にスペーサーを配置して、金属配線の間に樹脂を加圧充填して硬化することにより、スペーサの変形、及びスペーサの金属配線内へのもぐり込みによって、樹脂の硬化による収縮が抑制されて樹脂表面が凹凸のない平滑面になり、樹脂と透明電極を良好に密着させることができる。

【００６６】また、本発明に係る配線基板を備えた液晶素子によれば、スペーサの変形、及びスペーサの金属配線内へのもぐり込みによって樹脂表面が凹凸のない平滑面になるので、配向膜の表面も凹凸のない平滑面となって均一に配向処理されることによって液晶分子の反転が均一に行われることにより、光学状態のムラやクロストーク等をなくして表示品位の向上を図ることができる。

【図面の簡単な説明】

【図１】本発明の第１の実施の形態に係る配線基板を備えた液晶素子を示す概略断面図。

【図２】第１の実施の形態に係る配線基板の製造方法を説明するための図で、（ａ）は金属配線上にスペーサーを配置した状態を示す図、（ｂ）は金属配線の間にＵＶ硬化樹脂を滴下した状態を示す図、（ｃ）は型板でＵＶ硬化樹脂を挟む状態を示した図。

【図３】本実施の形態に係る配線基板の製造方法を説明するための図で、（ａ）はプレス機により型板でＵＶ硬化樹脂を加圧した状態を示す図、（ｂ）はＵＶ硬化樹脂にＵＶ光を照射している状態を示す図、（ｃ），（ｄ）は型板をＵＶ硬化樹脂から離した状態を示す図。

【図４】ＵＶ硬化樹脂上に透明電極を形成して得られた第１の実施の形態に係る配線基板を示す図。

【図５】第２の実施の形態に係る配線基板の製造方法を説明するための図で、（ａ）は型板上のスペーサー間にＵＶ硬化樹脂を滴下した状態を示す図、（ｂ）は金属配線を形成したガラス基板でＵＶ硬化樹脂を挟む状態を示した図。

【図６】第３の実施の形態に係る配線基板の製造方法を説明するための図で、（ａ）は表面にスペーサーを設けた金属配線の間にカラーフィルターを形成した状態を示す図、（ｂ）はカラーフィルター上にＵＶ硬化樹脂を充填して硬化した状態を示す図、（ｃ）はＵＶ硬化樹脂上に透明電極を形成して得られた第３の実施の形態に係る配線基板を示す図。

【図７】第４の実施の形態に係る配線基板の製造方法を

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説明するための図で、（ａ）はカラーフィルター上に表面にスペーサーを設けた金属配線を形成した状態を示す図、（ｂ）はカラーフィルター上にＵＶ硬化樹脂を充填して硬化した状態を示す図、（ｃ）はＵＶ硬化樹脂上に透明電極を形成して得られた第４の実施の形態に係る配線基板を示す図。

【図８】第５の実施の形態に係る配線基板の製造方法を説明するための図で、（ａ）はカラーフィルター上に保護層を介して表面にスペーサーを設けた金属配線を形成した状態を示す図、（ｂ）は保護層上にＵＶ硬化樹脂を充填して硬化した状態を示す図、（ｃ）はＵＶ硬化樹脂上に透明電極を形成して得られた第５の実施の形態に係る配線基板を示す図。

【図９】従来例に係る配線基板の製造方法を説明するための図で、（ａ）はガラス基板上に金属配線を形成した状態を示す図、（ｂ）は金属配線の間にＵＶ硬化樹脂を滴下した状態を示す図、（ｃ）は型板でＵＶ硬化樹脂を挟む状態を示した図。

【図１０】従来例に係る配線基板の製造方法を説明するための図で、（ａ）はプレス機により型板でＵＶ硬化樹＊

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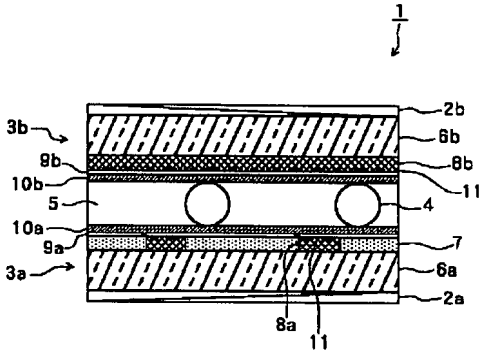
＊脂を加圧した状態を示す図、（ｂ）はＵＶ硬化樹脂にＵＶ光を照射している状態を示す図、（ｃ），（ｄ）は型板をＵＶ硬化樹脂から離した状態を示す図。

【図１１】ＵＶ硬化樹脂上に透明電極を形成して得られた従来例に係る配線基板を示す図。

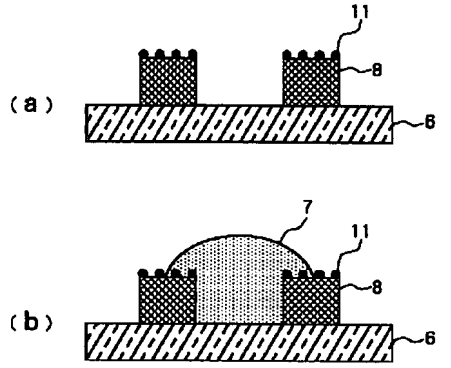
【符号の説明】

１　液晶素子
３ａ，３ｂ　電極基板（配線基板）
５　カイラルスメクチック液晶（液晶）
６、６ａ，６ｂ　ガラス基板（基板）
７　ＵＶ硬化樹脂（樹脂）
８、８ａ，８ｂ　金属配線
９、９ａ，９ｂ　透明電極
１０ａ，１０ｂ　配向膜
１１　スペーサー
１２　型板
１３　ＵＶ光（光）
１４，１６　カラーフィルター
１５　インク受容層
１７　保護層

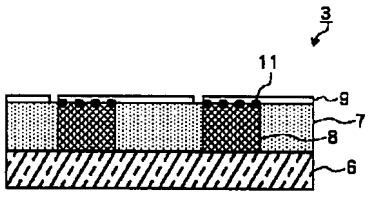
【図１】

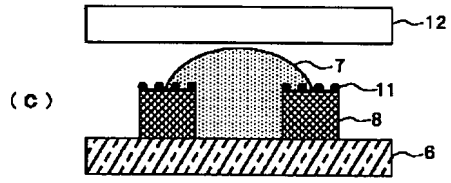


【図２】



【図４】





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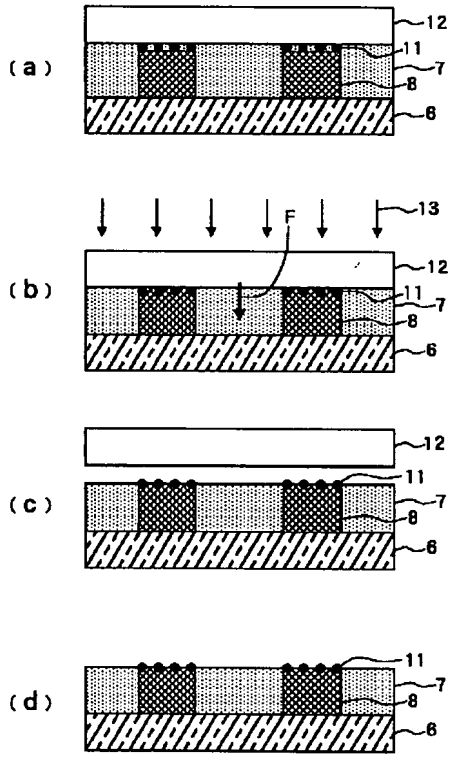

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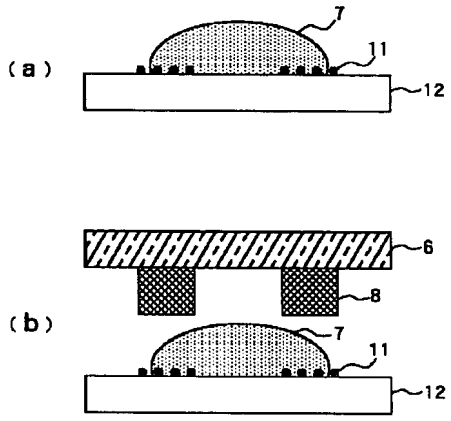

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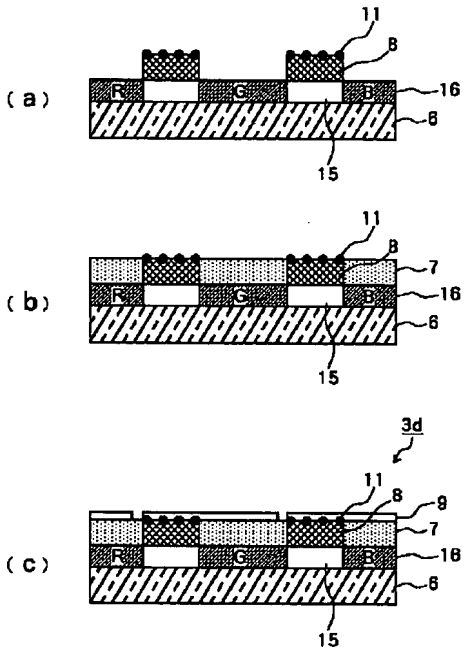

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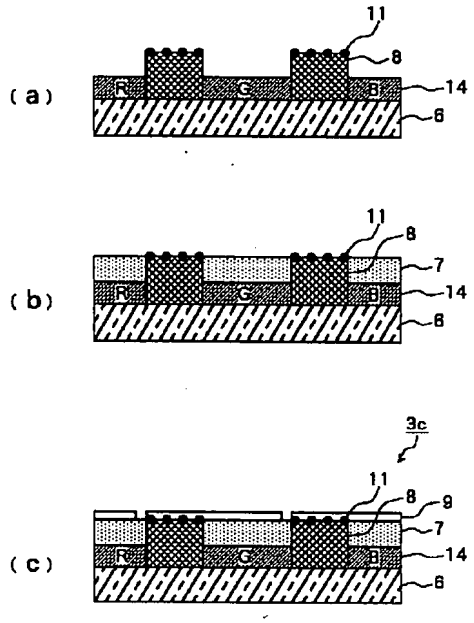
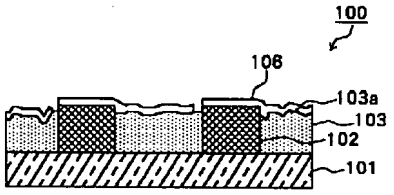


【図11】



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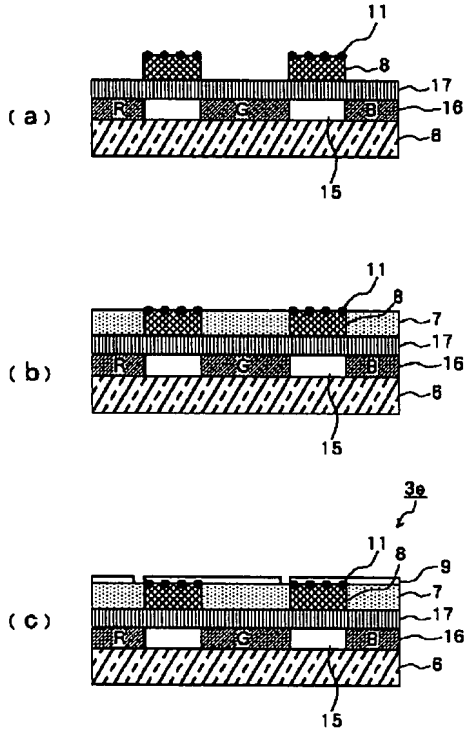
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G
B
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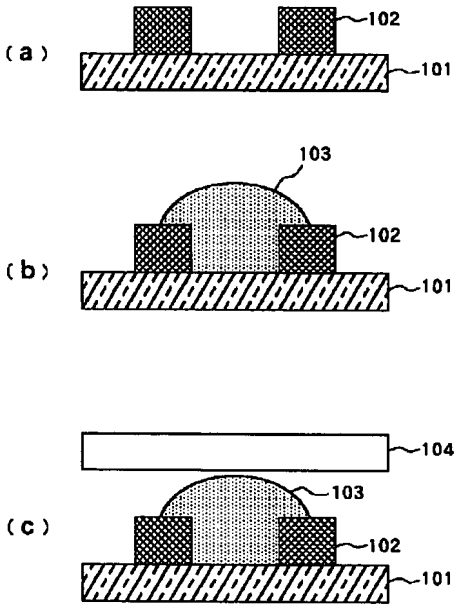
8
7
17
R
G
B
16
8
15
(c)
3e
11
8
9
7
17
R
G
B
16
8
15

【図9】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103
102
101
(c)
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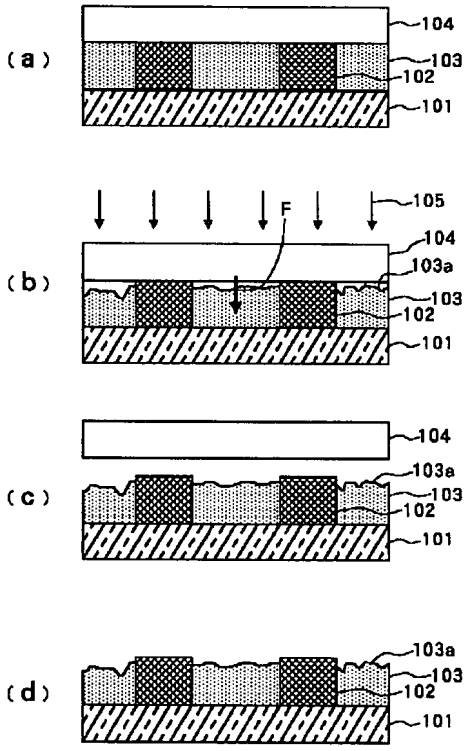
103
102
101

【図10】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103a
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101
(c)
104
103a
103
102
101
(d)
103a
103
102
101

フロントページの続き

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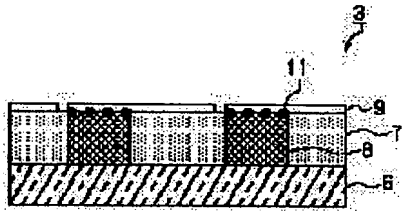
(54) WIRING BOARD, ITS PRODUCTION AND LIQUID CRYSTAL ELEMENT HAVING THIS WIRING BOARD

(57)Abstract:
PROBLEM TO BE SOLVED: To obtain a wiring board with which the curing of the surface of the resin packed between metallic wirings to a smooth surface is possible by arranging spacers in at least part of the boundary surface of the metallic wirings and transparent electrodes.
SOLUTION: An Al film is formed by a sputtering method on a glass substrate 6 to form the metallic wirings 8. Further, the spacers 11 of a silica glass system are dispersed into a solvent and the soln. prepd. in such a manner is applied on the surface of the metallic wirings 8 and is then cured. The UV curing resin 7 is dropped in a prescribed amt. between the respective metallic wirings 8 on this glass substrate 6 and thereafter, a mold plate having the smooth surface through which UV light passes is brought into contact with the UV curing resin 7. Next, a prescribed pressure is applied on the integral assembly of the glass substrate 6 and the mold plate holding the UV curing resin 7 to bring both into tight contact with each other. Next, the integral assembly of the glass substrate 6 and the UV curing resin 7 is peeled from the mold plate and transparent electrodes 9 are formed on the UV curing resin 7 in compliance with the wiring patterns of the metallic wirings 8. An alignment layer is formed thereon, by which the wiring board 3 is obtd.



LEGAL STATUS

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[Date of requesting appeal against examiner's decision of rejection]
[Date of extinction of right]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the liquid crystal device equipped with a wiring substrate especially the wiring substrate in which the transparent electrode was formed on metal wiring, its manufacture approach, and this wiring substrate.
[0002]
[Description of the Prior Art] Generally in liquid crystal devices, such as TN (Twisted Nematic) and a STN (Super Twisted Nematic) mold, the ITO (Indium TinOxide) film is conventionally used for the transparent electrode formed on a glass substrate.
[0003] Since the ITO film which constitutes the transparent electrode mentioned above has high resistance, delay of the voltage waveform impressed with enlargement of a screen product and highly-minute-izing like recently has been a problem. Especially, in the liquid crystal device using a ferroelectric liquid crystal, since the cel gap was as narrower as 1-3 micrometers, delay of a voltage waveform was remarkable. Moreover, in order to make resistance low, forming a transparent electrode thickly was also considered, but when thickness was thickened, there were troubles, like that time amount and cost start membrane formation and transparency worsens.
[0004] In order to solve such a trouble, the electrode substrate of a configuration of annexing to the thin transparent electrode of thickness and forming metal wiring of low resistance value is proposed (for example, JP,2-63019,A). The electrode substrate currently indicated by this official report embeds metal wiring with a transparent insulating material, and forms transparent electrodes, such as ITO film, on metal wiring which exposed the metal pattern to the front face.
[0005] When producing the electrode substrate of a configuration as mentioned above, the electrode substrate of the configuration using resin transparent as an insulating material which fills and carries out flattening of between metal wiring is proposed (for example, JP,6-347810,A).
[0006] When such metal wiring of low resistivity was formed in the glass substrate of the substrate which forms a transparent electrode and an electrode substrate (wiring substrate) was produced, it was carried out by the manufacture approach as shown in the former, for example, drawing 9 , thru/or drawing 11 .
[0007] First, the metal wiring 102 which consists of about 1-micrometer thickness is formed on a glass substrate 101 (refer to drawing 9 (a)). FOTORISO after the metal wiring 102 forms a metal membrane layer on a glass substrate 101 by a spatter etc. -- pattern NINGU can be carried out by law and it can form.
[0008] Next, it is made to contact so that specified quantity dropping of the UV (ultraviolet rays) hardening resin 103 may be carried out with a quantum liquefaction fixture (illustration abbreviation) (refer to drawing 9 (b)) and UV hardening resin 103 may be inserted with the smooth template 104 on the glass substrate 101 which performed silane coupling processing (refer to drawing 9 (c)).
[0009] Next, with a glass substrate 101 and a template 104, an object is put in in a press machine (illustration abbreviation), is really which sandwiched UV hardening resin 103 pressurized, and a glass substrate 101 and a template 104 are stuck (refer to drawing 10 (a)). In order for transparent electrodes, such as ITO film, and the metal wiring 102 to contact at a next

process and to maintain conductivity at this time, it is strong and, moreover, a glass substrate 101 and a template 104 are stuck to homogeneity all over a substrate so that it may become extent in which UV hardening resin 103 is removed from on the front face of the metal wiring 102, or resin remains very thinly.
[0010] Next, in order to stiffen this UV hardening resin 103, the one object of a glass substrate 101 and a template 104 is taken out from the inside of a press machine (illustration abbreviation), the UV (ultraviolet rays) light 105 is irradiated from a template 104 side, and UV hardening resin 103 is stiffened (refer to drawing 10 (b)).
[0011] Next, the one object of a glass substrate 101 and UV hardening resin 103 was exfoliated from the template 104 with the mold release fixture (illustration abbreviation) (refer to drawing 10 (c) and (d)), and membrane formation and the electrode substrate (wiring substrate) 100 which carried out patterning and embedded the metal wiring 102 UV hardening resin 103 had been obtained for the transparent electrode 106 which consists of ITO film on UV hardening resin 103 as touches the metal wiring 102 electrically (refer to drawing 11).
[0012]
[Problem(s) to be Solved by the Invention] By the way, in the electrode substrate (wiring substrate) 100 produced by the conventional manufacture approach mentioned above, as shown in drawing 10 (b), when the UV light 105 was irradiated by UV hardening resin 103, contraction arose on the front face according to the shrinkage force F by hardening of UV hardening resin 103, and there was a trouble that the front face of UV hardening resin 103 was set to concave convex [not a smooth side but] 103a. Hereafter, it explains that the front face of UV hardening resin 103 is set to concave convex 103a.
[0013] Generally UV hardening resin 103 has several% of hardening contraction alpha, for example, is 2 - 5% by epoxy system resin 6 to 10% in acrylic resin. And if thickness of the metal wiring 102 formed on a glass substrate 101 is set to h, the shrinkage force which is equivalent to the UV hardening resin 103 with which it fills up between the metal wiring 102 per unit volume and at alpha(hardening contraction) xh (thickness), i.e., the force which it is going to shrink by the thickness of alpha(hardening contraction) xh (thickness), will work to the interface of a template 104 and UV hardening resin 103.
[0014] Under the present circumstances, it works as force which is going to tear off UV hardening resin 103 not from the glass substrate 101 with which silane coupling processing is performed but from the template 104 with which silane coupling processing is not performed, consequently UV hardening resin 103 releases from mold the shrinkage force mentioned above since the metal wiring 102 functioned as a stanchion between a template 104 and UV hardening resin 103 from a template 104 in order to raise the adhesion of UV hardening resin 103.
[0015] And since this mold release takes place rapidly, in case it releases from mold, concave convex 103a by contraction will be formed in the front face of UV hardening resin 103.
[0016] Thus, when the front face of UV hardening resin 103 is set to concave convex 103a, in the transparent electrode 106 which consists of ITO film formed by the front face, a front face turns into a concave convex instead of a smooth side similarly. For this reason, the surface smoothness of the contact surface of UV hardening resin 103 and a transparent electrode 106 worsens, and the adhesion of UV hardening resin 103 and a transparent electrode 106 worsens.
[0017] Furthermore, in the liquid crystal device which pours in liquid crystal between this wiring substrate (wiring substrate) 100 of a pair, and is obtained, the front face of the orientation film (illustration abbreviation) formed on a transparent electrode 106 turns into a concave convex similarly. For this reason, orientation processing changed into the condition of it having not been uniform and having been confused, and there was a trouble of the nonuniformity and the cross talk of an optical condition having occurred and causing deterioration of display grace.
[0018] Then, this invention aims at offering the liquid crystal device equipped with the wiring substrate which it can harden by making into a smooth field the resin front face with which it is filled up between metal wiring, its manufacture approach, and this wiring substrate.
[0019]
[Means for Solving the Problem] In the wiring substrate which has the transparent electrode formed in the substrate front face between metal wiring by which the circuit pattern was carried

out, and said metal wiring at said this metal wiring, resin [which was filled up with the almost same thickness], and resin top as touched said metal wiring electrically in order to solve the above problems, it is characterized by to have arranged the spacer to a part of interface [at least] of said metal wiring and said transparent electrode.
[0020] Moreover, the 1st process which forms metal wiring on a substrate and the 2nd process which is filled up with resin between said metal wiring, and pressurizes said resin through a template, In the manufacture approach of a wiring substrate of having the 3rd process which said resin is irradiated [process] and makes it hardening light, and the 4th process which forms said transparent electrode as releases said template from mold and touches said metal wiring electrically on said resin It is characterized by arranging a spacer between said metal wiring and said templates, and carrying out pressurization restoration of said resin between said metal wiring and said templates at said 2nd process.
[0021] In the liquid crystal device which comes to pinch liquid crystal between the electrode substrates of the pair arranged so that it may counter mutually moreover, said one [at least] electrode substrate A substrate, metal wiring by which the circuit pattern was carried out to said substrate front face, and the resin filled up with this metal wiring and the almost same thickness between said metal wiring, the transparent electrode formed on said resin as touched said metal wiring electrically -- since -- it is characterized by having arranged the spacer to a part of interface [at least] of said metal wiring and transparent electrode.
[0022] Moreover, said spacer consists of a particle of textile glass yarn or a resin system, and it is characterized by the particle size being 0.01-1 micrometer.
[0023]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained based on a drawing.
[0024] Drawing 1 is the outline sectional view showing the liquid crystal device equipped with the wiring substrate concerning the gestalt of operation of the 1st of this invention. This liquid crystal device 1 is equipped with the electrode substrates 3a and 3b which are wiring substrates of the pair countered and arranged between polarizing plate 2a and 2b. The electrode substrates 3a and 3b The path is stuck about the predetermined cel gap (for example, 1.5 micrometers) by the uniform granular spacer 4, the chiral smectic liquid crystal 5 which is a ferroelectric liquid crystal which has a bistability to electric field in the meantime is poured in, and the closure is carried out by the seal member (illustration abbreviation).
[0025] The metal wiring 8a and 8b with which the electrode substrates (wiring substrate) 3a and 3b consist of a metal membrane of low resistance currently embedded in glass substrates 6a and 6b and the UV (ultraviolet rays) hardening resin 7 (not shown [the electrode substrate 3b side]) which is an insulator layer on glass substrate 6a and 6b, It consists of transparent electrodes 9a and 9b which consist of ITO film which was formed on metal wiring 8a and 8b, and is electrically in contact with the metal wiring 8a and 8b, respectively. On transparent electrode 9a and 9b, the orientation film 10a and 10b is formed, respectively.
[0026] The metal wiring 8a and 8b of each electrode substrates 3a and 3b and transparent electrodes 9a and 9b are formed in the shape of a stripe, respectively, passive-matrix arrangement is carried out, and the pixel is formed by the intersection.
[0027] As for glass substrates 6a and 6b, what has the thickness good [the parallelism which the quality of the material is easy to be a general thing like soda glass (blue plate glass), and ground both sides by about 1mm] well used as an object for liquid crystal substrates is desirable.
[0028] UV hardening resin 7 needs to have the thermal resistance which can bear the ITO spatter membrane formation process and orientation film baking process which are the mixture of UV hardening mold resin monomer, oligomer, and a photoinitiator, and are a liquid crystal substrate making process although the object of what kind of polymerization methods, such as acrylic, an epoxy system, and an en thiol system, is sufficient, chemical resistance, and washability. For example, what introduced the molecular structure which has thermal resistance in the reactant oligomer which is a principal component, and the thing which raised crosslinking density by polyfunctional monomer are desirable.

[0029] In addition, although UV (ultraviolet rays) light is irradiated by UV hardening resin 7, the resin hardened by the exposure of the light, infrared light, etc. besides UV hardening resin can also be used.
[0030] Moreover, in the front face of the metal wiring 8a and 8b, many granular spacers 11 are arranged and contraction of the front face by hardening of UV hardening resin 7 can be controlled at the time of manufacture (it mentions later for details).
[0031] As for a spacer 11, the conductive spacer which coated the metal with plating etc. is used in a fiber spacer, a silica glass system granular spacer, resin system granular spacers, or these spacer front faces. Moreover, although the magnitude of the path is based also on the thickness of the class metallurgy group wiring 8a and 8b of UV hardening resin 7, about 0.01-1-micrometer its about 0.05-0.5 micrometers are good preferably.
[0032] Next, the manufacture approach of the wiring substrate concerning the gestalt of this operation applied to the electrode substrates 3a and 3b of a liquid crystal device 1 mentioned above is explained with reference to drawing 2 thru/or drawing 4 .
[0033] First, aluminum (aluminum) film with a thickness of 2 micrometers was formed by the spatter with the dimension of 300x310mm on the glass substrate 6 with a thickness of 1.1mm by which double-sided polish was carried out, and the metal wiring 8 of a pitch 320micrometer stripe configuration was formed by width of face of 20 micrometers by the photolitho-etching method (refer to drawing 2 (a)). Furthermore, after making the solvent (for example, 99.99 weight sections of isopropyl alcohol) distribute the spacer (0.01 weight sections) 11 of a silica glass system with a mean particle diameter of 0.2 micrometers on the front face of this metal wiring 8 and applying to it with ink jet printer equipment (illustration abbreviation), the cure was carried out for 30 minutes at 120 degrees C (refer to drawing 2 (a)).
[0034] And on this glass substrate 6, the spin coat of the silane coupling agent (for example, Nippon Unicar make: A-174 (1 weight section) and ethyl alcohol (40 weight sections)) was carried out, heat treatment was performed at 100 degrees C for 20 minutes, and adhesion processing was performed.
[0035] Quantum dropping fixtures (illustration abbreviation), such as a dispenser, are used between each metal wiring 8 on a glass substrate 6. Next, UV hardening resin for example, the pentaerythritol thoria chestnut rate 50 weight section and the neopentyl-glycol-diacrylate 50 weight section -- After carrying out specified quantity dropping of the resin 7 of 7% of hardening contraction which consists of the 1-hydroxy cyclohexyl phenyl ketone 2 weight section, The template 12 with the smooth front face which UV light with a dimension of 300x310mm by which double-sided polish was carried out penetrates was slowly contacted to UV hardening resin 7 so that air bubbles might not be involved in (refer to drawing 2 (b) and (c)).
[0036] Next, the one object of a glass substrate 6 and a template 12 which sandwiched UV hardening resin 7 is received. It applies, for example for 1 minute from the upper and lower sides with a press machine (illustration abbreviation). A predetermined pressure Apply (3t of for example, press **), and it is made to stick over the whole surface (refer to drawing 3 (a)). As opposed to the one object of a glass substrate 6 and a template 12 removed from the press machine (illustration abbreviation) after that (for example, after about 10 minutes) The UV light (for example, UV light irradiated from the ultraviolet ray lamp which consisted of four high-pressure mercury lamps of 100w) 13 was irradiated from the template 12 side, and UV hardening resin 7 was stiffened (refer to drawing 3 (b)).
[0037] Under the present circumstances, when the shrinkage force F accompanying hardening of the UV hardening resin 7 by the exposure of the UV light 13 is controlled by the going underwater lump into deformation of the spacer 11 applied to the front face of the metal wiring 8, and the metal wiring 8 of a spacer 11, the front face of UV hardening resin 7 turns into a smooth side mostly. In addition, it can go underwater and the magnitude through which it passes in the metal wiring 8 of the spacer 11 by the shrinkage force accompanying hardening of UV hardening resin 7 and which is the path of a spacer 11 can adjust the amount of lumps.
[0038] Moreover, as a press machine which pressurizes UV hardening resin 7, the press machine by the oil hydraulic cylinder or the pneumatic cylinder, a roll press machine, etc. can be used, for example. In addition, in case it pressurizes with a press machine, by letting pass and heating in

the electrical heater or the heating fluid, the clay of UV hardening resin 7 falls and it spreads good on a glass substrate 6.

[0039] next, mold release equipment (illustration abbreviation) -- using -- the one object of a template 12 to the glass substrate 6, and UV hardening resin 7 -- exfoliating (drawing 3 (c) --) (d) It doubles with the circuit pattern of the metal wiring 8 so that the metal wiring 8 may be electrically touched on reference and UV hardening resin 7. For example, it spatter-formed, pattern NINGU of the transparent electrode 9 which consists of width-of-face [of 300 micrometers] and pitch 320micrometer ITO film was carried out, the orientation film (illustration abbreviation) was formed on it, and the wiring substrate (it is equivalent to the electrode substrates 3a and 3b of the liquid crystal device 1 of drawing 1) 3 was obtained (refer to drawing 4).

[0040] And the liquid crystal device 1 shown in drawing 1 was obtained by producing these two wiring substrates 3, carrying out opposite arrangement, sticking about the cel gap of about 1.5 micrometers, and pouring in chiral smectic liquid crystal between them.

[0041] Thus, with the gestalt of this operation, when the shrinkage force accompanying hardening of the UV hardening resin 7 by the exposure of the UV light 13 at the time of manufacture is controlled by the going underwater lump into deformation of the spacer 11 arranged on the front face of the metal wiring 8, and the metal wiring 8 of a spacer 11, the front face of UV hardening resin 7 turns into a smooth side.

[0042] Then, when microscope observation of the front face of this wiring substrate 3 was carried out, most irregularity of a front face like the conventional example shown in drawing 11 was not observed, but UV hardening resin 7 and a transparent electrode 9 were stuck good. Moreover, the spacer 11 was 300ohms or less in low resistance value, when going inside under about 0.14 micrometers from the front face of the metal wiring 8 was observed and it measured the resistance of the pattern length of this electrode substrate (wiring substrate) 3 further. And the liquid crystal device equipped with the wiring substrate (electrode substrate) 3 concerning the gestalt of this operation Since the front face of UV hardening resin 7 turns into a smooth side without irregularity as mentioned above When the front face of the orientation film also turned into a smooth side without irregularity and orientation processing was carried out at homogeneity, by carrying out reversal of a liquid crystal molecule to homogeneity, nonuniformity, a cross talk, etc. of an optical condition were able to be lost and improvement in display grace was able to be aimed at.

[0043] Moreover, by the configuration that the metal wiring 8 is put side by side to the bottom of a transparent electrode 9, when the resistance of an electrode becomes small, even if the ferroelectric liquid crystal (chiral smectic liquid crystal was used with the gestalt of this operation) is used for this liquid crystal device, it can reduce delay of a voltage waveform.

[0044] Furthermore, since this liquid crystal device does not have to thicken a transparent electrode 9 by juxtaposition of the metal wiring 8, the permeability of a transparent electrode 9 falls and this transparent electrode 9 is not recognized.

[0045] Drawing 5 (a) and (b) show typically the production process of the wiring substrate applied to the electrode substrates 3a and 3b of the liquid crystal device 1 concerning the gestalt of operation of the 2nd of this invention mentioned above.

[0046] After having arranged the spacer 11 on a template 12 by the same approach as the gestalt of the 1st operation mentioned above and dropping UV hardening resin 7 on this template 12 (refer to drawing 5 (a)), it was made to contact the metal wiring 8 of the glass substrate 6 which formed the metal wiring 8 from that upper part to UV hardening resin 7 with the gestalt of this operation (refer to drawing 5 (b)). Then, the wiring substrate was produced at the same process as the gestalt of the 1st operation shown in drawing 3 thru/or drawing 4 .

[0047] Thus, when the shrinkage force accompanying hardening of the UV hardening resin 7 by the exposure of the UV light 13 as well as the gestalt of the 1st operation was controlled also in the gestalt of this operation by the going underwater lump into deformation of the spacer 11 arranged on the front face of the metal wiring 8, and the metal wiring 8 of a spacer 11, the front face of UV hardening resin 7 turned into a smooth side, and UV hardening resin 7 and a transparent electrode 9 were stuck good.

[0048] Therefore, the liquid crystal device equipped with the wiring substrate (electrode substrate) concerning the gestalt of this operation Since the front face of UV hardening resin 7 turns into a smooth side without irregularity as mentioned above When the front face of the orientation film also turned into a smooth side without irregularity and orientation processing was carried out at homogeneity, by carrying out reversal of a liquid crystal molecule to homogeneity, nonuniformity, a cross talk, etc. of an optical condition were able to be lost and improvement in display grace was able to be aimed at.

[0049] Drawing 6 (a), (b), and (c) show typically the production process of the wiring substrate applied to the electrode substrates 3a and 3b of the liquid crystal device 1 concerning the gestalt of operation of the 3rd of this invention mentioned above.

[0050] With the gestalt of this operation, after forming the metal wiring 8 on the glass substrate 6 and applying a spacer 11 to the front face like the gestalt of the 1st operation, the color filter 14 of red (R), green (G), and the pigment system that consists of each blue (B) pixel was formed about 1-micrometer thickness for example, by the photolitho-etching method between the metal wiring 8 on a glass substrate 6 (refer to drawing 6 (a)). Then, UV hardening resin 7 is filled up with and stiffened between each metal wiring 8 on a color filter 14 at the same process as the gestalt of the 1st operation shown in drawing 3 thru/or drawing 4 (refer to drawing 6 (b)). According to the circuit pattern of the metal wiring 8, spatter-form, carry out pattern NINGU of the transparent electrode 9 which consists of width-of-face [of 300 micrometers], and pitch 320micrometer ITO film, and the orientation film (illustration abbreviation) is formed on it. Wiring substrate (it is equivalent to electrode substratesa [3] and 3b of liquid crystal device 1 of drawing 1) 3c was obtained (refer to drawing 6 (c)). Also in wiring substrate 3c which has a color filter function according to the gestalt of this operation thus, like the gestalt of the 1st operation The shrinkage force accompanying hardening of the UV hardening resin 7 by the exposure of the UV light 13 When controlled by the going underwater lump into deformation of the spacer 11 arranged on the front face of the metal wiring 8, and the metal wiring 8 of a spacer 11, the front face of UV hardening resin 7 turned into a smooth side mostly, and UV hardening resin 7 and a transparent electrode 9 were stuck good.

[0051] Therefore, the liquid crystal device equipped with wiring substrate (electrode substrate) 3c which has a color filter function concerning the gestalt of this operation Since the front face of UV hardening resin 7 turns into a smooth side without irregularity as mentioned above When the front face of the orientation film also turned into a smooth side without irregularity and orientation processing was carried out at homogeneity, by carrying out reversal of a liquid crystal molecule to homogeneity, nonuniformity, a cross talk, etc. of an optical condition were able to be lost and improvement in display grace was able to be aimed at.

[0052] In addition, a color filter 14 can be formed also by print processes, the sublimation replica method, and the ink jet method besides the photolitho-etching method.

[0053] Drawing 7 (a), (b), and (c) show typically the production process of the wiring substrate applied to the electrode substrates 3a and 3b of the liquid crystal device 1 concerning the gestalt of operation of the 4th of this invention mentioned above.

[0054] With the gestalt of this operation, first the ink absorbing layer (color filter layer) 15 of hydrophilic acrylic on the glass substrate 6 used with the gestalt of the 1st operation It forms in 0.8-micrometer thickness with a spin coat. With the ink jet printer for color filters (illustration abbreviation) after that for example, the water color ink for color filters For example, devote oneself by width-of-face [of 300 micrometers], and pitch 320micrometer, and it was made to sink into an ink absorbing layer 15, and further, at 200 degrees C, it heated for 30 minutes, hardening processing was carried out, and the color filter 16 was formed (refer to drawing 6 (a)).

[0055] And on this color filter 16, aluminum (aluminum) film with a thickness of 2 micrometers was formed by the spatter, the metal wiring 8 of width of face of 20 micrometers and a pitch 320micrometer stripe configuration was formed by the photolitho-etching method like the gestalt of the 1st operation, and the spacer 11 was applied to that front face (refer to drawing 10 (a)). Then, UV hardening resin 7 is filled up with and stiffened between each metal wiring 8 on a color filter 16 at the same process as the gestalt of the 1st operation shown in drawing 2 (b) thru/or drawing 3 (refer to drawing 7 (b)). According to the circuit pattern of the metal wiring 8, spatter-

CLAIMS

[Claim(s)]
[Claim 1] The wiring substrate characterized by what the spacer has been arranged for to a part of interface [at least] of said metal wiring and said transparent electrode in the wiring substrate which has the transparent electrode formed in the substrate front face between metal wiring by which the circuit pattern was carried out, and said metal wiring at said this metal wiring, resin [which was filled up with the almost same thickness], and resin top as touched said metal wiring electrically.
[Claim 2] It is the wiring substrate according to claim 1 the particle size of whose said spacer consists of a particle of textile glass yarn or a resin system, and is 0.01-1 micrometer.
[Claim 3] Said transparent electrode is a wiring substrate according to claim 1 which is the ITO film.
[Claim 4] Said metal wiring is a wiring substrate according to claim 1 formed with the metal or metal alloy of low resistance.
[Claim 5] Said resin is a wiring substrate according to claim 1 which is ultraviolet-rays hardening resin.
[Claim 6] The wiring substrate according to claim 1 which has arranged the color filter between said metal wiring on said substrate.
[Claim 7] The wiring substrate according to claim 1 which has arranged the color filter between said substrates and said metal wiring.
[Claim 8] The wiring substrate according to claim 7 in which the protective layer of said color filter was formed between said color filters and said metal wiring.
[Claim 9] The 1st process which forms metal wiring on a substrate, and the 2nd process which is filled up with resin between said metal wiring, and pressurizes said resin through a template, In the manufacture approach of a wiring substrate of having the 3rd process which said resin is irradiated [process] and makes it hardening light, and the 4th process which forms said transparent electrode as releases said template from mold and touches said metal wiring electrically on said resin The manufacture approach of the wiring substrate characterized by what a spacer is arranged between said metal wiring and said templates, and is done for the pressurization restoration of said resin between said metal wiring and said templates at said 2nd process.
[Claim 10] It is the manufacture approach of a wiring substrate according to claim 9 that said spacer consists of a particle of textile glass yarn or a resin system, and the particle size is 0.01-1 micrometer.
[Claim 11] Said transparent electrode is the manufacture approach of the wiring substrate according to claim 9 which is the ITO film.
[Claim 12] Said metal wiring is the manufacture approach of the wiring substrate according to claim 9 formed with the metal or metal alloy of low resistance.
[Claim 13] Said light is the manufacture approach of the wiring substrate according to claim 9 which is ultraviolet-rays light.
[Claim 14] Said resin is the manufacture approach of the wiring substrate according to claim 9 which is ultraviolet-rays hardening resin.

[Claim 15] The manufacture approach of the wiring substrate according to claim 9 which has arranged the color filter between said metal wiring on said substrate.
[Claim 16] The manufacture approach of the wiring substrate according to claim 9 which has arranged the color filter between said substrates and said transparent electrodes.
[Claim 17] The manufacture approach of the wiring substrate according to claim 16 in which the protective layer of said color filter was formed between said color filters and said metal wiring.
[Claim 18] In the liquid crystal device which comes to pinch liquid crystal between the electrode substrates of the pair arranged so that it may counter mutually said one [at least] electrode substrate A substrate, metal wiring by which the circuit pattern was carried out to said substrate front face, and the resin with which the almost same thickness was filled up with this metal wiring between said metal wiring, the transparent electrode formed on said resin as touched said metal wiring electrically -- since -- the liquid crystal device characterized by what the spacer has been arranged for to a part of interface [at least] of said metal wiring and said transparent electrode.
[Claim 19] It is the liquid crystal device according to claim 18 the particle size of whose said spacer consists of a particle of textile glass yarn or a resin system, and is 0.01-1 micrometer.
[Claim 20] Said substrate is a liquid crystal device according to claim 18 which is a glass substrate.
[Claim 21] Said transparent electrode is a liquid crystal device according to claim 18 which is the ITO film.
[Claim 22] Said metal wiring is a liquid crystal device according to claim 18 formed with the metal or metal alloy of low resistance.
[Claim 23] Said resin is a liquid crystal device according to claim 18 which is ultraviolet-rays hardening resin.
[Claim 24] The liquid crystal device according to claim 18 which has arranged the color filter between said metal wiring on said substrate.
[Claim 25] The liquid crystal device according to claim 18 which has arranged the color filter between said substrates and said metal wiring.
[Claim 26] The liquid crystal device according to claim 25 in which the protective layer of said color filter was formed between said color filters and said metal wiring.
[Claim 27] Said liquid crystal is a liquid crystal device according to claim 18 which is a ferroelectric liquid crystal.
[Claim 28] Said ferroelectric liquid crystal is a liquid crystal device according to claim 27 which is chiral smectic liquid crystal.
[Claim 29] The liquid crystal device according to claim 18 in which the orientation film was formed on said transparent electrode.
[Claim 30] Said transparent electrode of each of said electrode substrate and said metal wiring are a liquid crystal device according to claim 18 by which passive-matrix arrangement is carried out.

[Translation done.]

form, carry out pattern NINGU of the transparent electrode 9 which consists of width-of-face [of 300 micrometers], and pitch 320micrometer ITO film, and the orientation film (illustration abbreviation) is formed on it. 3d (it is equivalent to the electrode substrates 3a and 3b of the liquid crystal device 1 of drawing 1) of wiring substrates was obtained (refer to drawing 7 (c)).
[0056] Also in 3d of wiring substrates which have the metal wiring 8 on a color filter 16 according to the gestalt of this operation thus, like the gestalt of the 1st operation The shrinkage force accompanying hardening of the UV hardening resin 7 by the exposure of the UV light 13 When controlled by the going underwater lump into deformation of the spacer 11 arranged on the front face of the metal wiring 8, and the metal wiring 8 of a spacer 11, the front face of UV hardening resin 7 turned into a smooth side, and UV hardening resin 7 and a transparent electrode 9 were stuck good.
[0057] Therefore, the liquid crystal device equipped with 3d (electrode substrate) of wiring substrates which have a color filter function concerning the gestalt of this operation Since the front face of UV hardening resin 7 turns into a smooth side without irregularity as mentioned above When the front face of the orientation film also turned into a smooth side without irregularity and orientation processing was carried out at homogeneity, by carrying out reversal of a liquid crystal molecule to homogeneity, nonuniformity, a cross talk, etc. of an optical condition were able to be lost and improvement in display grace was able to be aimed at.
[0058] Drawing 8 (a), (b), and (c) show typically the production process of the wiring substrate applied to the electrode substrates 3a and 3b of the liquid crystal device 1 concerning the gestalt of operation of the 5th of this invention mentioned above.
[0059] With the gestalt of this operation, the color filter 16 was formed in the ink absorbing layer 15 on the glass substrate 6 used with the gestalt of the 1st operation by the same approach as the gestalt of the 4th operation mentioned above (color FIRU layer), and the protective layer (for example, transparence coating agent of a polyamide system) 17 was further formed in the front face with a spin coat and baking at about 0.5-micrometer thickness. Then, on this protective layer 17, aluminum (aluminum) film with a thickness of 2 micrometers was formed by the spatter, the metal wiring 8 of width of face of 20 micrometers and a pitch 320micrometer stripe configuration was formed by the photolitho-etching method like the gestalt of the 1st operation, and the spacer 11 was applied to that front face (refer to drawing 8 (a)).
[0060] Then, UV hardening resin 7 is filled up with and stiffened between each metal wiring 8 on a protective layer 17 at the same process as the gestalt of the 1st operation shown in drawing 2 (b) thru/or drawing 3 (refer to drawing 8 (b)). According to the circuit pattern of the metal wiring 8, spatter-form, carry out pattern NINGU of the transparent electrode 9 which consists of width-of-face [of 300 micrometers], and pitch 320micrometer ITO film, and the orientation film (illustration abbreviation) is formed on it. Wiring substrate (it is equivalent to electrode substratesa [3] and 3b of liquid crystal device 1 of drawing 1) 3e was obtained (refer to drawing 8 (c)).
[0061] Also in wiring substrate 3e which has the metal wiring 8 on the protective layer 17 of a color filter 16 according to the gestalt of this operation thus, like the gestalt of the 1st operation The shrinkage force accompanying hardening of the UV hardening resin 7 by the exposure of the UV light 13 When controlled by the going underwater lump into deformation of the spacer 11 arranged on the front face of the metal wiring 8, and the metal wiring 8 of a spacer 11, the front face of UV hardening resin 7 turned into a smooth side mostly, and UV hardening resin 7 and a transparent electrode 9 were stuck good.
[0062] Therefore, the liquid crystal device equipped with wiring substrate (electrode substrate) 3e which has a color filter function concerning the gestalt of this operation Since the front face of UV hardening resin 7 turns into a smooth side without irregularity as mentioned above When the front face of the orientation film also turned into a smooth side without irregularity and orientation processing was carried out at homogeneity, by carrying out reversal of a liquid crystal molecule to homogeneity, nonuniformity, a cross talk, etc. of an optical condition were able to be lost and improvement in display grace was able to be aimed at.
[0063] Moreover, by the protective layer 17 formed on the color filter 16, when the metal wiring 8 is formed by the photolitho-etching method, decolorization of the color filter 16 by etching

reagents, such as an acid, etc. can be prevented.
[0064]
[Effect of the Invention] According to this invention, as explained above, contraction by hardening of the resin with which it fills up between metal wiring is controlled with the spacer arranged to the interface of metal wiring and a transparent electrode, a resin front face is smooth and the wiring substrate which resin and a transparent electrode stuck good can be offered.
[0065] Moreover, according to the manufacture approach of the wiring substrate concerning this invention, by arranging a spacer between metal wiring and a template, carrying out pressurization restoration and hardening resin between metal wiring, it can become the smooth side where contraction by hardening of resin is controlled and a resin front face does not have irregularity, and resin and a transparent electrode can be stuck good by the going underwater lump into deformation of a spacer and metal wiring of a spacer.
[0066] Moreover, since a resin front face turns into a smooth side without irregularity by the going underwater lump into deformation of a spacer and metal wiring of a spacer according to the liquid crystal device equipped with the wiring substrate concerning this invention When the front face of the orientation film also turns into a smooth side without irregularity and orientation processing is carried out at homogeneity, by carrying out reversal of a liquid crystal molecule to homogeneity, nonuniformity, a cross talk, etc. of an optical condition can be lost and improvement in display grace can be aimed at.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The outline sectional view showing the liquid crystal device equipped with the wiring substrate concerning the gestalt of operation of the 1st of this invention.
[Drawing 2] For drawing showing the condition of having arranged the spacer on metal wiring, and (b), in drawing for explaining the manufacture approach of the wiring substrate concerning the gestalt of the 1st operation, (c) is [(a)] drawing showing the condition that UV hardening resin was dropped between metal wiring, and drawing having shown the condition of inserting UV hardening resin with a template.
[Drawing 3] For drawing showing the condition of having pressurized UV hardening resin with the press machine at the template, and (b), in drawing for explaining the manufacture approach of the wiring substrate concerning the gestalt of this operation, drawing showing the condition of irradiating UV light at UV hardening resin, (c), and (d) are [(a)] drawing showing the condition of having separated the template from UV hardening resin.
[Drawing 4] Drawing showing the wiring substrate concerning the gestalt of the 1st operation which formed the transparent electrode on UV hardening resin, and was obtained.
[Drawing 5] For (a), in drawing for explaining the manufacture approach of the wiring substrate concerning the gestalt of the 2nd operation, drawing showing the condition that UV hardening resin was dropped between the spacers on a template, and (b) are drawing having shown the condition of inserting UV hardening resin with the glass substrate in which metal wiring was formed.
[Drawing 6] It is drawing showing the wiring substrate concerning the gestalt of the 3rd operation which drawing showing the condition that (a) formed a color filter between metal wiring which formed the spacer in the front face, drawing showing the condition that (b) filled up with and hardened UV hardening resin on a color filter, and (c) formed a transparent electrode on UV hardening resin with drawing for explaining the manufacture approach of the wiring substrate concerning the gestalt of the 3rd operation, and was obtained.
[Drawing 7] It is drawing showing the wiring substrate concerning the gestalt of the 4th operation which drawing showing the condition that (a) formed metal wiring which formed the spacer on the front face on the color filter, drawing showing the condition that (b) filled up with and hardened UV hardening resin on a color filter, and (c) formed a transparent electrode on UV hardening resin with drawing for explaining the manufacture approach of the wiring substrate concerning the gestalt of the 4th operation, and was obtained.
[Drawing 8] In drawing for explaining the manufacture approach of the wiring substrate concerning the gestalt of the 5th operation Drawing showing the condition that (a) formed metal wiring which formed the spacer on the front face through the protective layer on the color filter, For (b), (c) is drawing showing the condition of having filled up with and hardened UV hardening resin on the protective layer, and drawing showing the wiring substrate concerning the gestalt of the 5th operation which formed the transparent electrode on UV hardening resin, and was obtained.
[Drawing 9] For drawing showing the condition of having formed metal wiring on the glass substrate, and (b), in drawing for explaining the manufacture approach of the wiring substrate concerning the conventional example, (c) is [(a)] drawing showing the condition that UV hardening resin was dropped between metal wiring, and drawing having shown the condition of inserting UV hardening resin with a template.
[Drawing 10] For drawing showing the condition of having pressurized UV hardening resin with the press machine at the template, and (b), in drawing for explaining the manufacture approach of the wiring substrate concerning the conventional example, drawing showing the condition of irradiating UV light at UV hardening resin, (c), and (d) are [(a)] drawing showing the condition of having separated the template from UV hardening resin.
[Drawing 11] Drawing showing the wiring substrate concerning the conventional example which formed the transparent electrode on UV hardening resin, and was acquired.
[Description of Notations]
1 Liquid Crystal Device
3a, 3b Electrode substrate (wiring substrate)
5 Chiral Smectic Liquid Crystal (Liquid Crystal)
6, 6a, 6b Glass substrate (substrate)
7 UV Hardening Resin (Resin)
8, 8a, 8b Metal wiring
9, 9a, 9b Transparent electrode
10a, 10b Orientation film
11 Spacer
12 Template
13 UV Light (Light)
14 16 Color filter
15 Ink Absorbing Layer
17 Protective Layer

[Translation done.]

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http://www4.ipdl.inpit.go.jp/cgi-bin/tran_web_cgi_ejje 2007/05/09

IDS REFERENCES

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